58. $\frac{dy}{dt} = k\frac{A}{V}(c-y)$

y = conc. in cell

k, A, V constant

c = conc outside cell

$y < c$

a) solve for y

$$\int \frac{dy}{c-y} = \int k\frac{A}{V}\,dt$$

$$-\ln(c-y) = k\frac{A}{V}\cdot t + C_1$$

$$e^{\ln(c-y)} = e^{\left(-k\frac{A}{V}t + C_1\right)}$$

$$c-y = e^{-k\frac{A}{V}t}\cdot e^{C_1} = C_1 e^{-k\frac{A}{V}t}$$

$y = y_0$, $t = 0$, $C_1 = c - y_0$

solve for y

$$c-y = (c-y_0)e^{-k\frac{A}{V}t}$$

$$c - (c-y_0)e^{-k\frac{A}{V}t} = y$$

b) $\lim_{t\to\infty} y = C$

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35 $\frac{dy}{dx} = \sin^3 x$ $\quad y = 5$ when $x = 4$

$$y = \int_a^x \sin^3 t\,dt$$

$$\frac{d}{dx}\int_a^x \sin^3 t\,dt = \sin^3 x$$

$$y = \frac{\sin^4 x}{4}$$

$$y' = \frac{4\sin^3 x}{4}\cdot\cos x$$

$$y = \int_4^x \sin^3 t\,dt + 5$$

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57.

$\frac{dL}{dx} = -kL$

$\int \frac{dL}{L} = \int -k\,dx$

$e^{\ln L} = e^{(-kx + C)}$

$L = L_0 e^{-kx}$

$\ln\frac{1}{2} = \ln 1 - \ln 2$

$= -\ln 2$

half life = 18

$x = 18 \quad L = \frac{1}{2}L_0$

solve for k

$\frac{1}{2}L_0 = L_0 e^{-k \cdot 18}$

$\ln\frac{1}{2} = -k \cdot 18$

$k = \frac{\ln\frac{1}{2}}{\cdot 18}$

$k = \frac{-\ln 2}{-18} = \frac{\ln 2}{18}$

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